Educational Background

The educational achievement of scientists and engineers differs among racial and ethnic groups. On average, black and Hispanic scientists and engineers have a lower level of educational achievement than scientists and engineers of other racial and ethnic groups. A bachelor's degree is more likely to be the highest degree achieved for black and Hispanic scientists and engineers than for white or Asian scientists and engineers—in 1999, a bachelor's degree was the highest degree achieved for 61 percent of black scientists and engineers in the U.S. workforce compared with 56 percent of all scientists and engineers.

Labor Force Participation, Employment, and Unemployment

Labor force participation rates vary by race and ethnicity. Minority scientists and engineers are more likely than whites to be in the labor force (that is, employed or seeking employment). Between 89 and 93 percent of black, Asian, Hispanic, and American Indian scientists and engineers were in the labor force in 1999 compared with 86 percent of white scientists and engineers. (See appendix table 3-38.) Age somewhat explains these differences. On average, white scientists and engineers are older than scientists and engineers of other racial and ethnic groups: 28 percent of white scientists and engineers were age 50 or older in 1999 compared with 15–20 percent of Asians, blacks, and Hispanics. For those in similar age groups, the labor force participation rates of white and minority scientists and engineers are similar. (NSF 1999b.)

Although minorities are for the most part less likely than nonminorities to be out of the labor force, minorities in the labor force are more likely to be unemployed. In 1999, the unemployment rate of white scientists and engineers was somewhat lower than that of other racial and ethnic groups. (See text table 3-7.) The unemployment rate for whites was 1.5 percent compared with 1.8 percent for Hispanics, 2.6 percent for blacks, and 1.5 percent for Asians. In 1993, the unemployment rate for whites was 2.4 percent compared with 3.5 percent for Hispanics, 2.8 percent for blacks, and 4.0 percent for Asians.

The differences in 1999 unemployment rates are evident within fields of S&E as well as for S&E as a whole. For example, the unemployment rate for white engineers was 1.8 percent; for black and Asian engineers, it was 2.3 and 1.8 percent, respectively.

Sector of Employment

Racial and ethnic groups differ within employment sector due in part to differences in field of employment. Among employed scientists and engineers in 1999, 58 percent of blacks, 60 percent of Hispanics, and 56 percent of American Indians were employed in for-profit business or industry compared with 64 percent of white and 70 percent of Asians. (See appendix table 3-40.) Blacks and American Indians are concentrated in social sciences (a field that provides less opportunity for employment in business or industry) and are underrepresented in engineering (a field that provides greater opportunity for employment in business or industry). On the other hand, Asians are overrepresented in engineering; thus, they are more likely to be employed by private, for-profit employers.

Black, Hispanic, and American Indian S&E job-holders are also more likely than other groups to be employed in government (Federal, state, or local): 20 percent of black, 15 percent of Hispanic, and 18 percent of American Indian scientists and engineers were employed in government in 1999 compared with 12 percent of white and Asian scientists and engineers.

Salaries

Salaries for S&E job-holders vary among racial and ethnic groups. In 1999, for all scientists and engineers, the median salaries by racial and ethnic group were $61,000 for whites, $62,000 for Asians, $53,000 for blacks, $55,000 for Hispanics, and $50,000 for American Indians. (See figure 3-16 and text table 3-8.) These salary patterns are about the same as they were in 1993.

Within occupational fields and age categories, median salaries of scientists and engineers by race and ethnicity are not dramatically different and do not follow a consistent pattern. For example, in 1999, the median salary of 20- to 29-year-old engineers with bachelor's degrees ranged from $35,000 for American Indians to $46,000 for Hispanics. Among those between the ages of 40 and 49, the median salary ranged from $60,000 for Asians and Native Americans to $70,000 for whites. The median salary of engineers with bachelor's degrees in 1999 who had received their degrees within the past five years was $45,000 for all ethnicities. (See appendix table 3-26.) Among those who had received their degrees 20–24 years ago, the median salary was approximately $70,000 for all ethnicities. See sidebar, "Salary Differentials."

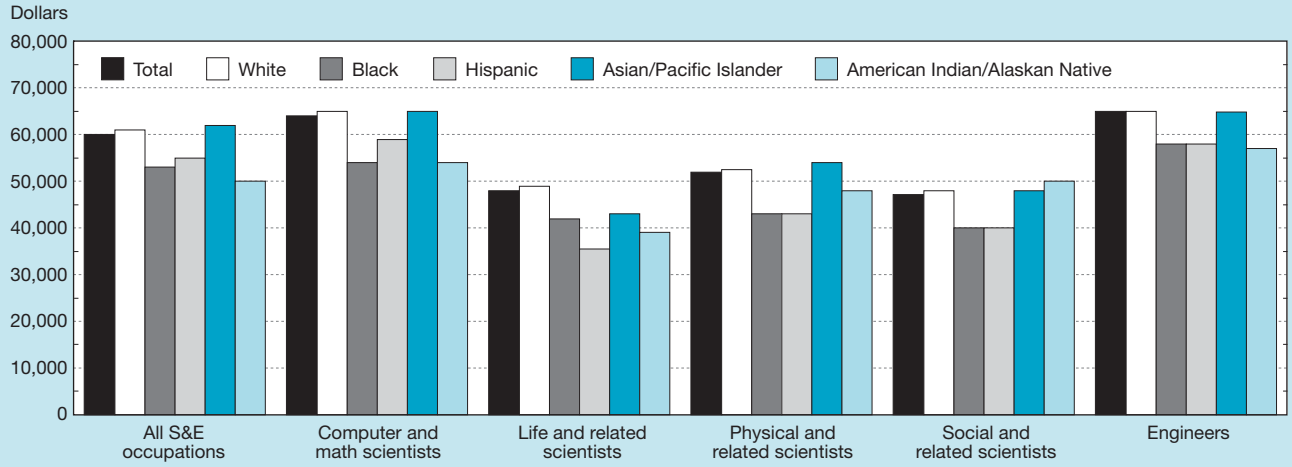
Labor Market Conditions for Recent S&E Degree-Holders

Recipients of Bachelor's and Master's Degrees

Recent recipients of S&E bachelor's and master's degrees form a key component of the U.S. S&E workforce: they account for almost one-half of the annual inflow to the S&E labor market (NSF 1990).[13] Recent graduates' career choices and entry into the labor market affect the supply and demand

[13] Data for this section are taken from the *1999 National Survey of Recent College Graduates.* This survey collected information on the 1999 workforce status of 1997 and 1998 bachelor's and master's degree recipients in S&E fields. Surveys of recent S&E graduates have been conducted biennially for NSF since 1978. For information on standard errors associated with survey data, see NSF (forthcoming b).

Figure 3-16.
Median annual salaries of scientists and engineers, by broad occupation and race/ethnicity: 1999



See appendix table 3-26.

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for scientists and engineers in the United States. This section offers insight into the labor market conditions for recent S&E graduates in the United States. Topics examined include graduate school enrollment rates, employment by level and field of degree, employment sectors, and median annual salaries.

Employment Versus Graduate School

In 1999, approximately one-fifth of 1997 and 1998 graduates who earned bachelor's or master's degrees were enrolled full time in graduate school. Students who had majored in physical and life sciences were more likely to be full-time graduate school students than were graduates with degrees in computer and information sciences and engineering. (See appendix table 3-45.)

Employment Related to Level and Field of Degree

Success in the job market varies significantly by level and field of degree. One measure of success is the likelihood of finding employment directly related to a graduate's field of study. Almost one-half of master's recipients but only one-fifth of bachelor's recipients were employed in their fields of study in 1999. Among both master's and bachelor's recipients, students who had received their degrees in either engineering or computer sciences were more likely to be working in their fields of study than degree recipients in other S&E fields, whereas students in social sciences were less likely than their counterparts in other S&E fields to have jobs directly related to their degrees.

Sector of Employment

The private, for-profit sector is the largest employer of recent S&E bachelor's and master's degree- recipients. (See text table 3-10.) In 1999, 63 percent of bachelor's degree-recipients and 57 percent of master's degree-recipients found employment in private, for-profit companies. The academic sector is the second largest employer of recent S&E graduates. Master's degree-recipients were more likely to be employed in four-year colleges and universities (12 percent) than were bachelor's degree-recipients (8 percent). The Federal sector employed only 5 percent of S&E master's degree-recipients and 4 percent of S&E bachelor's degree-recipients in 1999. Engineering graduates are more likely than science graduates to find employment in the Federal sector. Other sectors employing small numbers of recent S&E graduates include educational institutions other than four-year colleges and universities, nonprofit organizations, and state and local government agencies. Very small percentages of engineering bachelor's and master's recipients were self-employed (1 and 2 percent, respectively).

Employment and Career Paths

Career-path jobs are those that will help graduates fulfill their future career plans. As one might expect, S&E master's degree-recipients are more likely than S&E bachelor's degree-recipients to report having a career-path job. Approximately three-fourths of all master's degree-recipients and three-fifths of all bachelor's degree- recipients found a career-path job in 1999. Graduates with degrees in computer and information sciences or in engineering are more likely to find career-path jobs than graduates with degrees in other fields; about four-fifths of bachelor's and master's degree graduates in computer and information sciences and in engineering reported that they had found career-path jobs.

Salaries

Of recent bachelor's degree-recipients in sciences, in 1999, those with degrees in computer and information sciences earned the highest median annual salaries ($44,000); for graduates with degrees in engineering, those with degrees in electrical/electronics, computer, and communications engi-

Salary Differentials

Differences in salaries of women and ethnic minorities are often used as indicators of progress that individuals in such groups are making in science and engineering (S&E). Indeed, as shown in text table 3-9, these salary differences are substantial when comparing all individuals with S&E degrees by the level of degree: in 1999, women with S&E bachelor's degrees had full-time mean salaries that were 35.1 percent less than those of men with S&E bachelor's degrees.* Blacks, Hispanics, and individuals in other underrepresented ethnic groups with S&E bachelor's degrees had full-time salaries that were 21.9 percent less than those of non-Hispanic whites and Asians with S&E bachelor's degrees.** These raw differences in salary are lower but still large at the Ph.D. level (–25.8 percent for women and –12.7 percent for underrepresented ethnic groups). In contrast, foreign-born individuals with U.S. S&E degrees have slightly higher salaries than U.S. natives at the bachelor's and master's levels, but their salaries at the Ph.D. level show no statistically significant differences from those of natives.

However, differences in average age, work experience, field of degree, and other characteristics make direct comparison of salary and earnings statistics difficult. Generally, engineers earn a higher salary than social scientists, and newer employees earn less than those with more experience. One common statistical method that can be used to look simultaneously at salary and other differences is regression analysis.† Text table 3-9 shows estimates of salary differences for different groups after controlling for several individual characteristics.

Although this type of analysis can provide insight, it cannot give definitive answers to questions about the openness of S&E to women and minorities for many reasons. The most basic reason is that no labor force survey ever captures all information on individual skill sets, personal background and attributes, or other characteristics that

* For consistency with the other salary differences shown in text table 3-9, these salary differences were generated from regressions of ln (full-time annual salary) on just a dummy variable for membership in the group being examined. This corresponds to differences in the geometric mean of salary, not to differences in median salary as reported elsewhere in this chapter.

** "Underrepresented ethnic group" as used here includes individuals who reported their race as black, Native American, or other or who reported Hispanic ethnicity.

† Specifically presented here are coefficients from linear regressions using the 1999 SESTAT data file of individual characteristics upon the natural log of reported full-time annual salary as of April 1999.

Text table 3-9.
Salary differentials controlling for individual characteristics: 1999
(Percentages)

Variable	Bachelor's	Master's	Doctorate
Female (compared with male)			
All with S&E degrees	–35.1	–28.9	–25.8
Controlling for			
Age and years since degree	–27.2	–25.5	–16.7
Plus field of degree	–14.0	–9.6	–16.7
Plus occupation and employer characteristics	–11.0	–8.0	–8.4
Plus family and personal characteristics	–10.2	–7.4	–7.4
Plus gender-specific marriage and child effects	–4.6	NS	–3.1
Black, Hispanic, and other (compared with non-Hispanic white and Asian)			
All with S&E degrees	–21.9	–19.3	–12.7
Controlling for			
Age and years since degree	–13.0	–14.6	–4.7
Plus field of degree	–8.6	–6.7	–2.2
Plus occupation and employer characteristics	–7.3	–4.2	NS
Plus family and personal characteristics	–5.7	–3.3	NS
Foreign born with U.S. degree (compared with native born)			
All with S&E degrees	3.7	9.5	NS
Controlling for			
Age and years since degree	6.7	12.4	7.8
Plus field of degree	NS	NS	NS
Plus occupation and employer characteristics	NS	–2.8	–2.8
Plus family and personal characteristics	NS	–3.1	–2.7

NS = not significantly different from zero at $P = .05$

NOTE: Linear regressions on ln(full-time annual salary).

SOURCE: National Science Foundation, Division of Science Resources Statistics (NSF/SRS), Scientists and Engineers Statistical Data System (SESTAT), 1999.

may affect compensation. In addition, even characteristics that are measurable are not distributed randomly among individuals. An individual's choice of degree field and occupation, for example, will reflect in part the real and perceived opportunities for that individual. The associations of salary differences with individual characteristics, not field choice and occupation choice, are examined here.

Effects of Age and Years Since Degree on Salary Differentials

Salary differences between men and women reflect to a large extent the lower average ages of women with degrees in most S&E fields. Controlling for differences in age and years since degree reduces salary differentials for women compared with men by about one-fourth at the bachelor's degree level (to –27.2 percent) and by about one-third at the Ph.D. level (to –16.7 percent).*

When controlling for differences in age and years since degree, even larger drops in salary differentials are found for underrepresented ethnic minorities. Such controls reduce salary differentials of underrepresented minorities compared with non-Hispanic whites and Asians by more than two-fifths at the bachelor's degree level (to –13.0 percent) and by nearly two-thirds at the Ph.D. level (to –4.7 percent).

Because foreign-born individuals in the labor force who have S&E degrees are somewhat younger on average than natives, controlling for age and years since degree moves their salary differentials in a positive direction—in this case, making an initial earnings advantage over natives even larger—to 6.7 percent for foreign-born individuals with S&E bachelor's degrees and to 7.8 percent for those with S&E Ph.D.s.

Effects of Field of Degree on Salary Differentials

Controlling for field of degree and for age and years since degree reduces the estimated salary differentials for women with S&E degrees to –14.0 percent at the bachelor's level and to –10.3 percent at the Ph.D. level.** These reductions generally reflect the greater concentration of women in the lower paying social and life sciences as opposed to engineering and computer sciences. As noted above, this identifies only one factor associated with salary differences and does not speak to why there are differences between males and females in field of degree or whether salaries are affected by the percentage of women studying in each field.

Field of degree is also associated with significant estimated salary differentials for underrepresented ethnic groups. Controlling for field of degree further reduces salary differentials to –8.6 percent for those with S&E bachelor's degrees and to –2.2 percent for those with S&E Ph.D.s. Thus, age, years since degree, and field of degree are associated with almost all doctorate-level salary differentials for underrepresented ethnic groups.

Compared with natives at any level of degree, foreign-born individuals with S&E degrees show no statistically significant salary differences when controlling for age, years since degree, and field of degree.

Effects of Occupation and Employer on Salary Differentials

Obviously, occupation and employer characteristics affect compensation.† Academic and nonprofit employers typically pay less for the same skills that employers pay for in the private sector, and government compensation falls somewhere between the two groups. Other factors affecting salary are relation of work performed to degree earned, whether the person is working in S&E, whether the person is working in research and development, size of employer, and U.S. region. However, occupation and employer characteristics may not be determined solely by individual choice, for they may also reflect in part an individual's career success.

When comparing women with men and underrepresented ethnic groups with non-Hispanic whites and Asians, controlling for occupation and employer reduces salary differentials only slightly beyond what is found when controlling for age, years since degree, and field of degree. For foreign-born individuals compared with natives, controls for occupation and employer characteristics also produce only small changes in estimated salary differentials, but in this case, the controls result in small negative salary differentials at the master's (–2.8 percent) and doctorate (–2.8 percent) levels.

Effects of Family and Personal Characteristics on Salary Differentials

Marital status, children, parental education, and other personal characteristics are often associated with differences in compensation. Although these differences may indeed involve discrimination, they may also reflect many subtle individual differences that might affect work productivity.‡ As with occupation and employer characteristics, controlling for these characteristics changes salary differentials only slightly at any degree level. However, most of the remaining salary differentials for women disappear when the regression equations allow for the separate effects of marriage and children for each sex. Marriage is associated with higher salaries for both men and women, but marriage has a larger positive association for men. Children have a positive association with salary for men but a negative association with salary for women.

* In the regression equation, this is the form: age, age,^{2} age,^{3} age,^{4} years since highest degree (YSD), YSD,^{2} YSD,^{3} YSD.^{4}

** Included were 20 dummy variables for NSF/SRS SESTAT field-of-degree categories (out of 21 S&E fields; the excluded category in the regressions was "other social science").

† Variables added here include 34 SESTAT occupational groups (excluding "other non-S&E"), whether a person said his job was closely related to his degree, whether a person worked in R&D, whether his employer had less than 100 employees, and the census region of the employer.

‡ Variables added here include dummy variables for marriage, number of children in the household younger than 18, whether the father had a bachelor's degree, whether either parent had a graduate degree, and citizenship. Also, sex, nativity, and ethnic minority variables are included in all regression equations.

Text table 3-10.
Employed 1997 and 1998 S&E bachelor's and master's degree recipients, by sector of employment and field of degree: 1999

Degree[b]	Total employed (thousands)	Sector of employment[a] (percent distribution)						
		Educational		Noneducational				
		Four-year college and university	Other institution	Private, for-profit company	Self-employed	Nonprofit organization	Federal Government	State or local government
S&E bachelor's	539.2	8	10	63	1	7	4	7
All sciences	442.4	9	12	58	2	9	4	8
All engineering	96.7	4	1	86	<0.5	1	5	4
S&E master's	118.1	12	9	57	2	7	5	7
All sciences	80.6	15	12	48	3	10	4	9
All engineering	37.6	8	<0.5	78	1	1	8	4

[a]Sector of employment in which the respondent was working on his or her primary job held on April 15, 1999. In this categorization, those working in four-year colleges and universities or university-affiliated medical schools or research organizations were classified as employed in the "four-year college and university" sector. Those working in elementary, middle, secondary, or two-year colleges or other educational institutions were categorized in the group "other institution." Those reporting that they were self-employed but in an incorporated business were classified in the "private, for-profit sector."

[b]For graduates with more than one eligible degree at the same level (bachelor's/master's), the degree for which the graduate was sampled was used.

NOTE: Details may not add to totals because of rounding. Percentages were calculated on unrounded data.

SOURCE: National Science Foundation, Division of Science Resources Statistics (NSF/SRS), National Survey of Recent College Graduates, 1999.

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neering earned the highest salaries ($46,000). The same pattern was true for master's degree graduates: master's degree-recipients in computer and information sciences earned the highest median salaries ($58,000), as did those who earned master's degrees in electrical/electronics, computer, and communications engineering ($60,000).

Recipients of Doctoral Degrees

Analyses of labor market conditions for Ph.D.-holding scientists and engineers often focus on the ease or difficulty of beginning careers for new Ph.D. recipients. Several recent developments have contributed to these concerns, including demographic changes (which have slowed the growth of undergraduate enrollment), reductions in defense and research funding, growth in the importance of Ph.D. programs at foreign schools, and rates of Ph.D. production that approach or exceed the high levels realized at the end of the Vietnam draft.

Since the 1950s, the Federal Government has actively encouraged graduate training in S&E through numerous mechanisms. However, widespread unemployment or involuntary departure from S&E by many new Ph.D.-holding scientists and engineers could adversely affect the quality of scientific research in the United States. If labor market difficulties are real but temporary, promising students may be discouraged from pursuing degrees in S&E fields. To the extent that doctoral-level training provides higher level skills, this circumstance could eventually reduce the ability of industry, academia, and government to perform R&D. If labor market difficulties are long term, graduate education may need to be restructured to both maintain quality research and better prepare students for their real career options. In either case, when much high-level human capital goes unused, society loses potential opportunities for new knowledge and economic advancement, and individuals become frustrated with their careers. Of course, that some highly skilled individuals become either unemployed or employed IOF because they are unable to secure desired employment may reflect their unrealistic labor market expectations.

Most individuals who complete an S&E doctorate are looking for more than steady employment at a good salary. Their technical and problem-solving skills make them highly employable, but opportunity to do the type of work they want and for which they have been trained is important to them. For that reason, no single measure can satisfactorily describe the S&E labor market. Some of the available labor market indicators, such as unemployment rates, out-of-field and in-field employment, satisfaction with field of study, employment in academia, postdoctorate appointments, and salaries, are discussed below.

Aggregate measures of labor market conditions changed only slightly for recent doctoral degree-recipients in S&E (defined here as 1–3 years after receipt of degree). Unemployment fell from 1.5 percent in 1997 to 1.2 percent in 1999. (See text table 3-11.) Likewise, the portion of recent Ph.D. recipients reporting that they were either working outside their fields because jobs in their fields were not available or involuntarily working part time decreased slightly from 4.5 to 4.2 percent. These aggregate numbers mask numerous changes, both positive and negative, in many individual disciplines. In addition, IOF and unemployment rates in many fields moved in opposite directions.

Unemployment Rates

Even for relatively good labor market conditions in the general economy, the 1.2 percent unemployment rate for recent S&E Ph.D. recipients is very low; the April 1999 unem-

ployment rate for all civilian workers was 4.4 percent.[14] In 1997, recent graduates in several Ph.D. disciplines had unemployment rates above 3 percent, which was still low but unusually high for a highly skilled group. Between 1997 and 1999, unemployment rates fell for recent Ph.D. recipients in most disciplines; the largest decrease was in chemistry, in which the unemployment rate fell from 3.5 to 0.5 percent. Unemployment rates of less than 1 percent were found in civil engineering (0.0 percent), mechanical engineering (0.3 percent), electrical engineering (0.76 percent), mathematics (0.7 percent), computer sciences (0.9 percent), physics and astronomy (0.0 percent), and economics (0.5 percent).[15]

[14]People are said to be unemployed if they were not employed during the week of April 15, 1999, and had either looked for work during the preceding four weeks or were laid off from a job.

[15]An unemployment rate of 0.0 does not mean that "zero" people in that field were unemployed; it means that the estimated rate from NSF's sample survey was less than 0.05 percent.

Text table 3-11.
Labor market rates for recent doctorate recipients one to three years after Ph.D.: 1997 and 1999
(Percentages)

Ph.D. field	Unemployment rate		Involuntary out-of-field rate	
	1997	1999	1997	1999
All S&E	1.5	1.2	4.5	4.2
Engineering	1.0	0.9	3.6	2.7
Chemical	1.7	1.7	5.8	1.8
Civil	0.0	1.5	5.5	0.0
Electrical	0.6	0.7	3.2	2.5
Mechanical	0.5	0.3	2.7	3.2
Other	1.6	0.9	3.0	3.6
Life sciences	1.7	1.1	2.6	2.5
Agriculture	2.2	0.0	7.3	3.1
Biological sciences	1.5	1.3	2.2	2.5
Computer sciences and mathematics	0.6	0.8	6.5	4.1
Computer sciences	0.7	0.9	2.1	1.8
Mathematics	0.6	0.7	11.0	6.2
Physical sciences	2.1	0.4	6.9	6.6
Chemistry	3.5	0.5	3.3	2.4
Geosciences	1.0	1.2	6.3	9.4
Physics and astronomy	0.7	0.0	12.2	11.1
Social sciences	1.6	2.1	5.4	5.7
Economics	0.9	0.5	5.2	4.2
Political science	2.6	3.4	7.9	11.6
Psychology	1.2	1.0	3.8	3.5
Sociology and anthropology	2.5	1.6	7.7	11.9
Other	2.5	1.9	7.1	4.4

SOURCE: National Science Foundation, Division of Science Resources Statistics (NSF/SRS), Survey of Doctorate Recipients, 1997 and 1999.

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Involuntarily Working Outside Field

Another 4.2 percent of recent S&E Ph.D. recipients in the labor force reported that they could not find (if they were seeking) full-time employment that was "closely related" or "somewhat related" to their degrees.[16] Although this measure is more subjective than the unemployment rate, the IOF rate often proves to be a more sensitive indicator of labor market difficulties for a highly educated and employable population. However, this tool is best used along with the unemployment rate as measures of two different forms of labor market distress.

The highest IOF rates were found for recent Ph.D. graduates in sociology and anthropology (11.8 percent) and political science (11.6 percent). These two fields also had unemployment rates that were among the highest. The lowest IOF rates were found in computer sciences (1.8 percent) and civil engineering (0.0 percent).

Tenure-Track Positions

Most S&E recipients do not ultimately work in academia, and in most S&E fields, this has been true for several decades. See chapter 10, "The Academic Doctoral S&E Workforce." In 1999, for S&E Ph.D.-holders four to six years since receipt of degree, 22.2 percent were in tenure-track or tenured positions at four-year institutions of higher education. (See text table 3-12.) Across fields, tenure-program academic employment for those four to six years since receipt of Ph.D. ranged from 6.5 percent in chemical engineering to 50.7 percent in political science. For Ph.D.-holders one to three years since receipt of degree, only 13.7 percent were in tenure programs, but this rate reflects the increasing use of postdoctoral appointments (or postdocs) by recent Ph.D.-holders in many fields.

Although academia must be considered just one possible sector of employment for S&E Ph.D.-holders, the availability of tenure-track positions is an important aspect of the job market for those who seek academic careers. The fall in rate of tenure-program employment for those four to six years since receipt of Ph.D. from 26.6 percent in 1993 to 22.2 percent in 1999 reflects both job opportunities in academia and alternative opportunities for employment. For example, one of the largest declines in tenure-program employment occurred in computer sciences (from 51.5 percent in 1993 to 31.6 percent in 1999), in which other measures of labor market distress are low, and computer science departments report difficulties recruiting faculty.[17] The attractiveness of other employment may also explain drops in tenure-program rates for several engineering disciplines. However, it is less likely to explain the smaller but steady drops in tenure-program employment rates in fields showing other measures of distress, such as physics and mathematics (both of which have large IOF rates) and biological sciences (which have low unem-

[16]Individuals were considered IOF if they said their jobs were not related to their degree because no jobs in their field were available or if they were part-time because a full-time job was not available. The IOF rate is a percentage calculated by dividing the number of such individuals by the total number in that segment of the labor force.

[17] See Computing Research Association (1997).

Text table 3-12.
Doctorate recipients holding tenure and tenure-track appointments at four-year institutions: 1993 and 1999
(Percentages)

Ph.D. field	Years since receipt of doctorate: 1993 1–3	1993 4–6	1999 1–3	1999 4–6
All S&E	18.4	26.6	13.7	22.2
Engineering	16.0	24.6	7.3	15.2
Chemical	8.1	14.0	2.4	6.5
Civil	24.7	27.1	20.3	33.6
Electrical	17.6	26.9	3.7	11.9
Mechanical	13.5	29.5	6.4	15.1
Other	13.9	21.3	9.5	16.0
Life sciences	12.6	24.8	11.3	21.8
Agriculture	15.6	27.0	13.6	23.3
Biological sciences	12.1	24.8	10.9	22.0
Computer sciences and mathematics	39.7	54.1	20.8	36.7
Computer sciences	37.1	51.5	20.3	31.6
Mathematics	41.8	56.0	21.3	41.0
Physical sciences	9.7	18.2	8.1	15.2
Chemistry	7.7	16.3	9.4	14.2
Geosciences	12.7	26.2	14.3	24.0
Physics and astronomy	12.0	17.7	3.5	12.0
Social sciences	26.4	29.2	24.0	28.7
Economics	46.6	48.6	30.4	34.3
Political science	53.9	47.1	37.3	50.7
Psychology	12.7	15.5	14.9	16.0
Sociology and anthropology	37.9	46.9	33.4	43.4
Other	37.4	48.8	30.4	48.6

SOURCE: National Science Foundation, Division of Science Resources Statistics (NSF/SRS), Survey of Doctorate Recipients, 1993 and 1999.

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ployment and IOF rates but show other indications of labor market distress). Between 1993 and 1999, small increases in tenure-program rates for Ph.D. recipients four to six years since receipt of degree were found in chemistry, geosciences, psychology, and sociology and anthropology.

Relation of Occupation to Field of Degree

By strict definition of occupational titles, 17 percent of employed recent Ph.D. recipients were in occupations outside S&E, often performing administrative or management functions. When asked how related their jobs were to their highest degrees achieved, only a small portion of recent Ph.D. recipients employed in non-S&E occupations said that their jobs were unrelated to their degrees. (See text table 3-13.) By field, the percentages ranged from 1.5 percent for recent Ph.D. graduates in psychology to 14.2 percent for recent Ph.D. graduates in physics and astronomy.

Satisfaction With Field of Study

One indicator of the quality of employment available to recent graduates is simply their answers to this question: "If you had the chance to do it over again, how likely is it that you would choose the same field of study for your highest degree?" When asked of those who received S&E degrees one to five years after their previous degrees, 16.6 percent of Ph.D. recipients said they were "not at all likely" compared with 20.2 percent of bachelor's recipients. (See text table 3-14.) This regret of field choice is lowest for recent Ph.D. recipients in computer sciences (6.8 percent), electrical engineering (9.8 percent), and social sciences (12.5 percent). The regret is greatest in physics (24.4 percent), chemistry (23.9 percent), and mathematics (22.4 percent).

Postdoctorate Appointments

A postdoctorate appointment (or postdoc) is defined here as a temporary position awarded in academia, industry, or government for the primary purpose of receiving additional research training. This definition has been used in the *Survey of Doctorate Recipients* when asking respondents about current and past postdoctorate positions they have held.[18] Data on postdoctorates are often analyzed in relation to recent Ph.D. labor market issues. Besides wanting to receive more training in research, recent Ph.D. recipients may accept temporary and usually lower paying postdoctorate positions because permanent jobs in their fields are not available.

Science and Engineering Indicators 1998 included an analysis of a one-time postdoctorate module from the *1995 Survey of Doctorate Recipients* that showed a slow increase

[18]It is clear, however, that the exact use of the term "postdoctorate" differs among academic disciplines, universities, and sectors that employ postdoctorates. These differences in usage have probably affected the self-reporting of postdoctorate status in the Survey of Doctorate Recipients.

Text table 3-13.
Recent Ph.D. scientists and engineers, by field of degree and relationship between Ph.D. field of study and occupation: 1999
(Percentages)

Ph.D. field	Relation of occupation to degree field: Same field	Other S&E	Related non-S&E	Nonrelated non-S&E
All S&E	71.1	11.9	14.4	2.6
Computer sciences	89.0	1.8	9.1	0.0
Engineering	75.0	17.8	5.5	1.7
Life sciences	65.2	7.5	24.1	3.2
Mathematics	84.2	3.1	6.3	6.4
Social sciences	74.6	5.8	16.9	2.7
Physical sciences	65.0	24.5	8.0	2.5

NOTE: Percentages may not add to 100 because of rounding.

SOURCE: National Science Foundation, Division of Science Resources Statistics (NSF/SRS), Survey of Doctorate Recipients, 1999.

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Text table 3-14.
Recent S&E graduates "not at all likely" to choose same field of study if they could do it over again by field and level of degree (one to five years after degree): 1997
(Percentages)

Field of degree	Bachelor's	Master's	Doctorate
All S&E fields	20.2	12.6	16.6
Engineering	11.3	12.6	14.8
Chemical	9.5	13.1	13.0
Civil	14.2	16.6	20.9
Electrical	8.3	6.5	9.8
Mechanical	10.2	16.6	16.0
Life sciences	16.8	13.9	18.3
Agriculture	20.7	18.4	20.7
Biological sciences	16.0	14.0	18.0
Computer sciences and mathematics	8.9	6.6	14.5
Computer sciences	6.8	5.3	6.8
Mathematics	12.0	10.3	22.0
Physical sciences	16.1	18.6	23.3
Chemistry	15.7	27.2	23.9
Geoscience	25.2	12.5	20.3
Physics	9.7	17.0	24.4
Social sciences	27.3	14.3	12.5
Economics	23.7	11.8	12.6
Political science	25.5	19.6	13.3
Psychology	28.4	13.7	10.8
Sociology and anthropology	31.2	15.7	15.5

SOURCE: National Science Foundation, Division of Science Resources Statistics (NSF/SRS), SESTAT Data File, 1997.

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in the use of postdocs in many disciplines over time.[19] Additionally, in physics and biological sciences (fields with the most use of postdocs), median time spent in postdocs extended well beyond the one to two years found in most other fields.

[19] This was measured cross-sectionally by looking at the percentage of those in each graduation cohort who reported ever being in a postdoc position.

Data from 1999 show a small decline from 1995 in the percentage of recent S&E Ph.D. recipients entering postdoctorate positions—from 32.7 percent of 1994 graduates in 1995 to 31.5 percent of 1998 graduates in 1999. However, in the biological sciences, which account for about two-thirds of all postdocs, the postdoc rate one year after receipt of degree increased slightly from 59.6 to 61.2 percent. At the same time, physics, the other traditionally large postdoc field, experienced a decline in the incidence of postdocs one year after receipt of degree from 57.1 percent in 1995 to 47.0 percent in 1999. In fields other than physics or biological sciences, the postdoctorate rate one year after receipt of degree continued a slow decline from 21.2 percent in 1995 and 19.9 percent in 1997 to 18.9 percent in 1999.

Reasons for Taking a Postdoc

Postdocs in 1999 were asked to state their reasons for taking their current postdoctorate appointments; for all fields of degree, 32.1 percent gave "other employment not available" as their primary reason. (See text table 3-15.) Most respondents gave reasons consistent with the defined training and apprenticeship functions of postdoctorate appointments—e.g., 20.2 percent said that postdocs were generally expected for careers in their fields, 17.6 percent said they were seeking additional training in their fields, and 11.1 percent said they were seeking additional training outside their fields.

What Were 1997 Postdocs Doing in 1999?

Of those in postdoctorate positions in April 1997, 33.8 percent remained in a postdoctorate position in April 1999 (see text table 3-16)—a small reduction from the 38.0 percent of 1995 postdocs who were still postdocs in 1997 (*Science and Engineering Indicators 2000*). Only 15.1 percent transitioned from a postdoctorate to a tenure-track position at a four-year educational institution (down from 16.5 percent in 1997); 16.1 percent found other employment at an educational institution; 25.0 percent were at a for-profit firm; 6.0 percent were employed at a nonprofit institution or by government; and 1.4 percent were unemployed.

Text table 3-15.
Primary reason for taking current postdoc by field: 1999
(Percentages)

Ph.D. field	Additional training in Ph.D. field	Training outside Ph.D. field	Postdoc generally expected in field	Work with particular person or place	Other employment not available	Other
All S&E fields	17.6	11.1	20.2	15.9	32.1	3.2
Biological sciences	16.7	9.6	19.4	14.1	38.0	2.2
Chemistry	17.3	16.7	11.8	28.4	24.8	1.0
Engineering	20.5	13.8	22.4	20.5	16.2	6.6
Geoscience	12.0	6.1	31.5	38.2	12.2	0.0
Physics	10.6	13.2	25.8	8.4	38.3	3.6
Psychology	23.0	11.0	19.1	11.6	31.8	3.7

SOURCE: National Science Foundation, Division of Science Resources Statistics (NSF/SRS), Survey of Doctorate Recipients, 1999.

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No information is available on the career intentions of those in postdoctorate positions, but it is often assumed that a postdoc is valued most by academic departments at research universities. However, more postdocs in each field accept employment with for-profit firms than obtain tenure-track positions, and many tenure-track positions are at schools where a research record is not of central importance.

Salaries for Recent S&E Ph.D. Recipients

For all fields of degree, the median salary for recent S&E Ph.D. recipients in 1999 was $49,000, a change of 13.5 percent from 1997. By field, salaries ranged from a low of $34,000 in biological sciences to a high of $75,000 in electrical engineering. (See text table 3-17.) For all Ph.D. recipients, those in the top 10 percent of salary distribution (90th percentile) earned $80,000. The 90th percentile salaries varied by fields, from a low of $60,000 for those in sociology and anthropology to a high of $101,000 for those in computer sciences. At the 10th percentile, representing the lowest pay for each field, salaries ranged from $24,000 for those in biology to $51,000 for those in electrical engineering.

Salaries for recent S&E Ph.D. recipients by sector of employment are provided in text table 3-18. In 1999, the median salary for a postdoc one to three years since receipt of degree was $30,000, less than one-half the median salary for a recent Ph.D. recipient working for a private company ($68,000). Many of the salary differentials between S&E fields are narrower when examined within employment sector. For those in tenure-track positions, median salaries ranged from $38,000 for chemistry to $61,000 for chemical engineering. At private, for-profit companies, median salaries ranged from $54,000 for sociology and anthropology to $82,000 for computer sciences.

Changes in median salaries for recent bachelor's, master's, and Ph.D. graduates (defined here as one to five years since receipt of degree) are shown in text table 3-19. For all S&E fields, median salaries for recent Ph.D. recipients rose 4.7 percent from 1997 to 1999; for bachelor's and master's degree graduates, median salaries rose 0.0 percent and 2.5 percent, respectively. Several individual disciplines reflected larger increases for Ph.D. recipients, including double-digit increases in physics (10.4 percent), mathematics (12.5 percent), computer sciences (12.0 percent), and economics (10.3 percent). A decline in median salaries occurred in biology (–3.7 percent).

Text table 3-17.
Salary distribution for recent doctorate recipients (1–3 years after degree): 1999
(Dollars)

Ph.D. field	Percentile				
	10th	25th	Median	75th	90th
Total	26,100	35,000	48,800	65,000	80,000
Computer sciences	48,000	60,000	75,000	89,000	101,000
Mathematical sciences	35,000	38,000	45,000	60,000	75,000
Life sciences	24,000	28,000	35,000	50,000	67,000
Physical sciences	27,000	35,000	52,000	65,000	76,000
Social sciences	30,000	37,200	45,000	56,000	75,000
Engineering	42,700	56,000	66,700	76,000	88,000

SOURCE: National Science Foundation, Division of Science Resources Statistics (NSF/SRS), Survey of Doctorate Recipients, 1999.

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Age and Retirement

The size of the S&E workforce, its productivity, and opportunities for new S&E workers are all greatly affected by the age distribution and retirement patterns of the S&E workforce. For many decades, rapid increases in new entries led to a relatively young S&E workforce with only a small percentage near traditional retirement ages. This general pic-

Text table 3-16.
What 1997 postdocs were doing in 1999, by field
(Percentages)

Ph.D. field	Postdoc	Tenure-track at four-year institution	Other education job	For-profit job	Government job	Unemployed
All S&E fields	33.8	15.1	16.1	25.0	6.0	1.4
Biological sciences	45.0	13.9	13.9	18.0	5.5	1.8
Chemistry	21.9	6.8	6.9	52.0	5.8	3.5
Engineering	21.1	17.3	11.9	41.2	6.9	1.7
Physics	31.8	7.6	26.4	23.4	7.9	0.0
Psychology	21.2	18.5	23.1	32.8	9.6	0.0

SOURCE: National Science Foundation, Division of Science Resources Statistics (NSF/SRS), merged 1997 and 1999 file from NSF's Survey of Doctorate Recipients.

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